

REMARKS

1. Information Disclosure Statement

The office action states that the previously submitted information disclosure statement (IDS) has not been considered because a legible copy of the cited reference was not provided with the IDS. In response, the applicant is submitting a copy of International Publication WO 03/069705 in accordance with 37 C.F.R. § 1.98(a)(2).

2. 35 U.S.C. §112 Rejections

Claims 11 and 14 stand rejected under 35 U.S.C. § 112, second paragraph for reciting claim limitations that lack proper antecedent basis. In the case of claim 11, the office action states that there is insufficient antecedent basis for the claimed “second inner fuel cell” and that for examination purposes “the claim will be interpreted as being dependent from claim 9.” Similarly, the office action states that claim 14 is interpreted as depending from claim 13.

In response, the applicant has amended claims 11 and 14 to depend from claims 9 and 13 respectively. The applicant submits that there now exists proper antecedent basis for the claimed “second inner fuel cell” and respectfully requests withdrawal of the rejections of claims 11 and 14.

3. 35 U.S.C. §102(b) Rejections

Claims 2, 5, 9, and 13 stand rejected under 35 U.S.C. § 102(b) as purportedly being anticipated by Japanese Patent No. 02-075167 to Shimozu (the “Shimozu reference”). In addition to asserting that certain electrodes of the Shimozu reference comprise cathodes, the office action states that “the ordinarily skilled artisan, based on the teachings of Shimozu as well as general knowledge of the art, would find that the electrolytes are of the same composition, and would all operate at or below a first maximum temperature.”

In response, the applicant submits that claims 2, 5, 9, and 13 have been amended to clarify the limitation that at least one of the electrolyte layers “has a different composition and different optimal operating temperature range than another electrolyte layer in the stack.” The amendments to the claims do not constitute new matter as support for the claims can be found in both the claims prior to the current amendments and on page 11, lines 4-20 of the specification as originally filed. The applicant also submits that the amendments to the claims should not require a new search as the limitations were already present in the claims.

The claim amendments more accurately reflect the fact that there are different compositions and different optimal operating temperature ranges for the inner, middle, and outer tubular solid oxide fuel cells. As stated by the office action, the Shimozu reference discloses a series of concentric solid oxide fuel cells but is silent as to “the composition of the electrode” and that one of ordinary skill in the art would “find that the electrolytes are of the same composition, and would all operate at or below a first maximum temperature.”

For a reference to be anticipating each and every element of applicant’s claimed subject matter must be contained in the cited reference. MPEP § 2131. Therefore, since the Shimozu reference is silent as to electrolytes selected for differing operation efficiencies within a temperature range for each of the inner and outer solid oxide fuel cells the applicant submits that claims 2, 5, 9, and 13 cannot be anticipated by the Shimozu reference. Accordingly, the applicant respectfully requests withdrawal of the rejections of the claims under 35 U.S.C. § 102(b).

4. 35 U.S.C. §103(a) Rejections

Claims 3, 4, 7, 8, 10-12, 14-18, 20-22, 24-26, 29, 30, and 33-37 have been rejected under 35 U.S.C. § 103(a) as being unpatentable over the Shimozu reference in view of multiple references. Specifically, claims 3, 4, 7, 8, 10-12, and 14-17 have been rejected over the Shimozu reference in view of U.S. Patent Pub. No. 2004/0072054 to

Cochran *et al.* (the “Cochran reference”). Claims 18, 20-22, 24, and 25 have been rejected as being unpatentable over the Shimozu reference in view of U.S. Patent Pub. No. 2002/0177026 to Hatano *et al.* (the “Hatano reference”). Claims 26, 29, 30, 33, 34, 36, and 37 stand rejected as being unpatentable over U.S. Patent Pub. No. 2003/0224232 to Browall *et al.* (the “Browall reference”) in view of U.S. Patent No. 7,067,215 to Lazaroff *et al.* (the “Lazaroff reference”). Finally, claim 35 has been rejected as purportedly being unpatentable over the Browall reference in view of the Lazaroff reference and in further view of U.S. Patent No. 5,518,829 to Satake *et al.* (the “satake reference”).

The office action asserts that it would have been obvious to one skilled in the art at the time of the invention to modify either the Shimozu reference or the Browall reference in some fashion to arrive at the present claims. However, in light of the Supreme Court decision in *KSR v. Teleflex*, any obviousness determination must be consistent with the traditional *Graham* factors. Thus, obviousness is determined according to (1) the scope and content of the prior art, (2) the level of ordinary skill in the art, (3) the differences between the prior art and the claimed invention, and (4) the extent of any objective indicia of nonobviousness.

Furthermore, the key to supporting any rejection under 35 U.S.C. § 103 is the clear articulation of the reason why the claimed invention would have been obvious. The analysis supporting a rejection under 35 U.S.C. § 103 should be made explicit. MPEP § 2143. Rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness. MPEP § 2142.

In addition, the examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. In the present case, the office action asserts that it “would have been obvious to one having ordinary skill in the art at the time of the invention to modify the teachings of Parsons and provide a cross-roller bearing or a ball bearing, as taught by Barnett, for the purpose of reducing friction such that the bearing

can rotate freely.” To reject a claim based on this rationale, the office action must resolve the *Graham* factual inquiries. Then, the office action must articulate the following:

- (1) a finding that the prior art included each element claimed, although not necessarily in a single prior art reference, with the only difference between the claimed invention and the prior art being the lack of actual combination of the elements in a single prior art reference;
- (2) a finding that one of ordinary skill in the art could have combined the elements as claimed by known methods, and that in combination, each element merely performs the same function as it does separately;
- (3) a finding that one of ordinary skill in the art would have recognized that the results of the combination were predictable; and
- (4) whatever additional findings based on the *Graham* factual inquiries may be necessary, in view of the facts of the case under consideration, to explain a conclusion of obviousness.

MPEP 2143(A).

The rationale to support a conclusion that the claim would have been obvious is that all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination yielded nothing more than predictable results to one of ordinary skill in the art. *KSR v. Teleflex*, 550 U.S. 398, 401, 82 USPQ2d at 1395; *Sakraida v. AG Pro, Inc.*, 425 U.S. 273, 282, 189 USPQ 449, 453 (1976); *Anderson's-Black Rock, Inc. v. Pavement Salvage Co.*, 396 U.S. 57, 62-63, 163 USPQ 673, 675 (1969); *Great Atlantic & P. Tea Co. v. Supermarket Equipment Corp.*, 340 U.S. 147, 152, 87 USPQ 303, 306 (1950). “[I]t can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *KSR*, 550 U.S. at 401, 82 USPQ2d at 1396. If any of these findings cannot be made, then this rationale cannot be used to support a conclusion that the claim would have been obvious to one of ordinary skill in the art. MPEP § 2143(A). In the present case, the office action fails to fulfill several of these criteria with respect to the various claims. Therefore, the applicant respectfully traverses each of the rejections made to claims 3-6 and 15-20 under 35 U.S.C. § 103(a) and

because the rejections cannot be sustained, the applicant submits that the rejections should be withdrawn.

The cited references fail to disclose the claimed elements and limitations

The Shimozu and Cochran references

The prior art references when modified still must teach or suggest all the claim limitations of the rejected claim. The 35 U.S.C. § 103 obviousness rejections of these claims are thus inappropriate because one does not arrive at the present invention as recited in the claims by modifying the Shimozu reference with the Cochran reference. Newly amended claims 2, 5, 9, and 13, upon which claims 3, 4, 7, 8, 10-12, and 14-17 depend, explicitly require that “the electrolyte layer of at least one of the inner, middle and outer tubular solid oxide fuel cells [have] a different composition and different optimal operating temperature range than another electrolyte layer in the stack.”

Both the Shimozu and Cochran references, however, are silent as to fuel cells having multiple electrolytes of differing compositions. Therefore, since neither of the cited references discloses each and every limitation of claims 2, 5, 9, and 13, the rejections of claims 3, 4, 7, 8, 10-12, and 14-17 are not supported and should be withdrawn.

The Shimozu and Hatano references

The office action states that the Shimozu reference teaches all of the limitations of claims 18, 20-22, 24, and 25 except that it “fails to teach the material from which the base board is made.” The office action then states that the Hatano reference teaches “a metal foam base [] for use with oxide fuel cells.” The applicant submits, however, that the references do not teach the limitations of newly amended independent claim 18. Claim 18 requires that each fuel cell sub-stack be “electrically interconnected to the support plate.” Neither the Shimozu nor the Hatano reference discloses such a feature. The Shimozu reference simply discloses a support plate upon which the fuel stacks are

arranged in a single plane. The Hatano reference on the other hand, discloses stacking each fuel cell in an end-to-end manner.

Therefore, since neither reference discloses using an electrically conductive support plate to interconnect each of the fuel sub-stacks, the applicant submits a *prima facie* case of obviousness has not been met and the rejection of independent claim 18 cannot be sustained and should be withdrawn. Accordingly, since claims 20-22, 24, and 25 depend from and include all of the limitations of independent claim 18, the rejections of claims 20-22, 24, and 25 should also be withdrawn.

The Browall and Lazaroff references

The office action contends that the Browall reference discloses a method for “making tubular solid oxide fuel cells” that is the same as the method of independent claim 26 except that the Browall reference fails “to teach sintering of the layers.” The office action then asserts that the Lazaroff reference teaches “a method of making a fuel cell which includes sintering of deposited electrode and electrolyte layers” and it would therefore have been obvious to one having ordinary skill in the art to combine the references.

The applicant submits that the office action has misinterpreted the teaching of the Browall reference and as a result reaches a conclusion inconsistent with the disclosure of the reference. For example, the office action states that “it is seen in Figure 1 that the cores are arranged side-by-side in a single row.” However, the elements that are arranged in a single row of Figure 1 of the Browall reference comprise “at least one reactant gas injector 140” and are not a core of any kind, let alone a combustible core as claimed. (See col. 2, lines 45-62 of the Browall reference). These gas injectors inject a “reactant gas” into the plasma stream that is “deposited on the surface 134 of a substrate 130.” (See col. 2, lines 39-41 of the Browall reference).

Independent claim 26 also requires “using one of electrophoretic deposition, metal electrodeposition and composite electrodeposition to deposit enough inner electrode material onto the cores.” The Browall reference discloses only using an “expanding

thermal plasma” to form the coating on the substrate. The Lazaroff reference is silent as to how the various layers are deposited and merely discloses fabricating a fuel cell by use of a chemical/mechanical planarization (CMP) process to remove portions of the layers after they have been deposited.

Furthermore, although the Lazaroff reference discloses the use of “sintering,” this is done only for the commonly understood purpose of forming the anode, cathode, and electrolyte layers by heating them to a particular temperature. Conversely, independent claim 26 explicitly requires that sintering be used such that “the combustible cores combust and a reactant channel is formed inside the inner electrode layer from each combusted core.” Similarly, independent claim 33 requires “sintering the layers such that the combustible cores combust, thereby forming an inner reactant channel for each fuel cell.”

Since neither reference discloses a combustible core or combusting a reactant channel via sintering, the applicant submits that the claimed limitations are not found in the cited references and the rejections cannot be supported and should be withdrawn. Inasmuch as claims 29, 30, and 34-37 depend from and include all of the limitations of independent claims 26 and 33, the applicant submits that the rejections of the claims cannot be sustained and should also be withdrawn.

The office action provides no valid finding that one of ordinary skill in the art could have combined the elements as claimed by known methods such that each element merely performs the same function as it does separately

To support the rejections, the office action must include a finding that (1) one of ordinary skill in the art could have combined the elements as claimed by known methods, and (2) that in combination, each element merely performs the same function as it does separately. The office action ignores these requirements. For example, as noted above, neither the Shimozu nor the Cochran reference discloses more than one electrolyte having “a different composition and different optimal operating temperature range than another electrolyte layer in the stack.” Therefore merely substituting “one or all of the known

electrolyte materials” from the Cochran reference would simply result in an electrolyte particularly suited for a single temperature range which is a different function than what is claimed.

Similarly, the metal foam base plate of the Hatano reference is designed to allow multiple fuel cells to be stacked in an end-to-end fashion. This configuration would result in a “series-connected circuit” which is a different function than the claimed electrically conductive support plate and sub-stacks which are “arranged side-by-side” and “electrically interconnected to the support plate.” Additionally, the office action contends that “the plate of Hatano et al. offers high gas-shielding and energy density as low manufacturing costs,” which is again a different function than what is claimed.

Therefore, the combination of elements as claimed in independent claims 2, 13, 26, and 33 is not merely performing the same function of each of the individually cited elements found in the references as claimed by the office action.

The office action fails to provide a showing that one of ordinary skill in the art would have recognized that the results of the combination were predictable

The office action fails to provide a valid motivation or suggestion based on the cited references that would lead one skilled in the art to arrive at the claimed invention. To support a finding of obviousness, the cited references must expressly or impliedly suggest the claimed invention or the examiner must provide a convincing line of reasoning as to why the claimed invention would have been obvious to one skilled in the art. Reliance upon the knowledge of the person of ordinary skill in the art is not sufficient without that knowledge being instantly and unquestionably demonstrable as being well-known. MPEP § 2144.03(A). Reliance on such “common knowledge” without greater support is specifically prohibited:

A statement that modifications of the prior art to meet the claimed invention would have been ‘well within the ordinary skill of the art at the time the claimed invention was made’ because the references relied upon teach that all aspects of the claimed invention were individually known in

the art is not sufficient to establish a *prima facie* case of obviousness without some objective reason to combine the teachings of the references.

Ex Parte Levengood, 28 USPQ2d 1300 (Bd. Pat. App & Inter. 1993). “There must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR v. Teleflex*, 127 S. Ct. 1727, 1741 (2007). Further, “a patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *Id.* It is important for the office action “to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does.” *Id.*

The Shimozu and Cochran references

The office contends that one of ordinary skill in the art could have substituted the known electrolyte materials from the Cochran reference for an electrolyte used in the Shimozu reference to achieve the predictable result of the claimed subject matter. This assertion is merely a statement of conclusion making the leap from a motivation to substitute a solid electrolyte for the unknown electrolyte of the Shimozu reference to the conclusion that doing so would have resulted in the predictable outcome of using multiple electrolytes, each with a differing composition and differing optimal operating range. The office action fails to identify where or how the cited references teach or suggest the use of more than one electrolyte. It is therefore unclear how one skilled in the art could predict that the Cochran reference would lead to the use of more than one electrolyte when it never considers such a concept.

The Shimozu and Hatano references

The office action also asserts that it would have been obvious for one of ordinary skill in the art to modify the Shimozu reference with the plate of the Hantano reference because “the plate of Hatano et al. offers high gas-shielding and energy density at low manufacturing costs.” However, as stated above, the Hatano reference discloses a foam metal plate that is designed to allow several fuel cells to be stacked on top of each other

in an end-to-end series. Therefore, if the Shimozu reference were modified with the Hatano reference as suggested by the office action, the likely result would be a series of stacked fuel cells instead of a group of unitary cells arranged in a plane on a base board.

The applicant also submits that one of ordinary skill in the art would not be motivated to combine the references as suggested by the examiner since they are inherently directed towards different outcomes. Specifically, the Shimozu reference merely discloses a group of fuel cells arranged in a plane while the Hatano reference is directed towards manufacturing fuel cells into a "series circuit." Therefore, one of ordinary skill in the art would not substitute one form of manufacture for the other when neither reference suggests any benefit of doing so.

The Browall, Lazaroff, and Satake references

The applicant submits that the Browall, Lazaroff, and Satake references provide absolutely no motivation to combine the references as suggested by the office action because none of the references disclose a single claimed limitation found in independent claims 26 and 33. For example and as stated above, none of the references disclose a "longitudinally-extending combustible core," the use of at least one of "electrophoretic deposition, metal electrodeposition and composite electrodeposition" to form an "inner electrode layer," or "sintering the layers such that the combustible cores combust" as claimed.

Because the claimed limitations are not present, it is impossible for the office action to provide the necessary "articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." Therefore the rejections of the claims are unsupportable and the rejections of claims 26, 29, 30, and 33-37 must be withdrawn.

The office action relies on hindsight to support the rejections

The applicant submits that, in view of the shortcomings of the cited references, the conclusions of the office action can only be reached through the impermissible use of

hindsight. The claimed invention is not simply a “predictable use of prior art elements according to their established functions,” and the office action provides no objective reason to combine their respective teachings to arrive at the claimed invention. “A factfinder should be aware ... of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning.” *KSR*, 127 S. Ct. at 1744.

In re McLaughlin states that hindsight reasoning is proper if it is only taking into account “knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant’s disclosure.” 443 F.2d 1392 (CCPA 1971). In the case of claims 26, 29, 30, and 33-37, it is therefore not understood how one of ordinary skill in the art would choose combine the cited references to reach the predictable results of sintering the combustible cores when not a single cited reference discloses a combustible core as claimed. Nor is there any support outside of the applicant’s specification for the contention that one of ordinary skill in the art would be motivated to substitute the electrolyte of the Shimozu reference with multiple other electrolytes.

The applicant submits that the present rejections are exactly the type of distortion that the court in *KSR* warned of. This is clearly inappropriate, as “the teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant’s disclosure.” MPEP § 2143. Here, the office action has failed to demonstrate that the prior art discloses the claimed elements in any manner. Because the office action cannot support the rejection without relying on the applicant’s disclosure and/or hindsight, the rejections are improper and should be withdrawn.

Therefore, the applicant respectfully submits that the Shimozu, Cochran, Hatano, Browall, Lazaroff, and Satake references do not render the claimed invention obvious because they do not disclose all of the limitations of the independent claims, the claimed elements do not merely perform the same function as they would separately, and the references provide no motivation to modify the systems of the Shimozu or Browall


references with the teachings of the additionally cited references to arrive at the claimed invention. The applicant, therefore, respectfully traverses the rejections and requests that the rejections of the claims 3, 4, 7, 8, 10-12, 14-18, 20-22, 24-26, 29, 30, and 33-37 under 35 U.S.C. § 103 be withdrawn.

CONCLUSION

Please consider the amendments and remarks. In view of the present amendments and comments, the applicant respectfully submits that the claims are in condition for allowance. Please contact the undersigned attorney at the address and telephone number noted below with any questions or comments.

Respectfully Submitted,

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Date



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